DRAFT
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ENERGY DOUBLER POWER SUPPLY LOCATION

The Energy Doubler power supply system will consist of energy transfer supplies capable of 75 GeV/sec ramping (12 kV maximum) and a holding power supply to provide precise current regulation during injection and flat-top.

The placement of energy transfer units must be made to equalize the voltage stress around the ring during ramping and dumping, hence a symmetrical arrangement with equal loads between power supplies is dictated. Existing 1 kV Main Ring power supplies are to be converted to doubler energy transfer use. The minimum voltage stress would be obtained by distributing these units individually around the ring at 12 equally spaced locations (one unit at every other service building).

Every energy transfer site must also contain an energy dumping system, power supply control and regulation electronics, quench detection and protection systems, low voltage drop 4500A buses from ring to service building, and full-current dc penetrations from room temperature environment to superconducting environment. The cost of these items is almost directly proportional to the number of energy transfer sites. Therefore, if voltage stress capability of the doubler magnet system can accommodate higher voltages, the system cost can be reduced by grouping two or more energy transfer units together at each site, reducing the number of sites accordingly.

These considerations have led to the present system design having six sites with two-1KV power supplies and a 0.5 ohm energy dump resistor at each site. The 2000 V ramping capability and closely matched 0.5Ω x 4300A = 2150V dumping voltage result in a maximum of ± 1 kV from coil to bus and coil to ground under normal ramping and energy dumping conditions. Some system faults, such as shorts from coil to ground at a position in the string near a power supply can result in a maximum voltage of 2 kV.

Each Main Ring service building contains two power supplies presently connected in the bend bus circuits. Twelve of the buildings (the "2" and "3" buildings)

also contain a third supply connected in the quad bus circuits. In addition, there are four buildings (B1, B4, E1, E4) in which redundant power supplies are installed, and service building F4 has a special quad bus power supply filling up the third position.

It is planned to install the low voltage holding power supply in the same service building as one of the energy transfer sites to avoid an additional full-current bus bar system and cryostat penetration. Choosing a building which presently has only two supplies installed for the holding supply location will minimize the perturbation to the Main Ring. Candidates are A1, A4, C1, C4, F1. If all other considerations are equal, proximity to the footprint area for this important doubler component causes one to select A1 as the holding power supply location, thus fixing the "1" buildings as the energy transfer sites. An additional influence toward selecting the "1" building is the existing use of the redundant power supply at B1 for energy doubler development programs at the awning. The first dump resistor (energy Fountain) was installed at B1 for this program; the second one has been installed at A1 for the sector test.

A "fold" in the doubler magnet system will occur at one location to feed the coil current back through the return bus. A long straight section is the most desirable location for this break in the loop inorder to save running the super-conducting bus through that long straight, i.e., at BØ where it is desirable to leave the long straight "empty" for colliding beam facilities. This fold forces a voltage zero at two places where the coil and bus leads are tied directly together. To minimize coil to bus voltage, this should occur at a location where the voltage would normally be zero, that is, halfway between two power supplies.

The "1" building power supply location does not satisfy the above condition if the fold is placed at the long straight seciton. A "2" or "3" building location ("2.5" would be ideal) would be more desirable from this viewpoint, but use of these buildings requires either a separate holding supply location or removal of one of the Main Ring quad supplies to make room for the holding supply. The two existing energy fountains would also need to be relocated.